

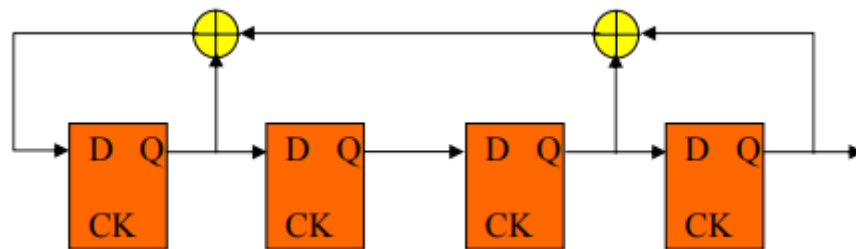
Assignment 5.1

Linear Feedback Shift Register

Introduction: -

What is LFSR?

- The **LFSR** is a **shift register** that has some of its outputs together in **exclusive-OR** or **exclusive-NOR** configurations to form a feedback path.
- The initial content of the shift register is referred to as **seed**. (Note: any value can be a seed except all 0's to avoid lookup state).
- Lookup state is the state in which shift register values are zeros all the time while shifting and xoring).
- Feedbacks can be comprising of **XOR** gates or **XNOR** gates



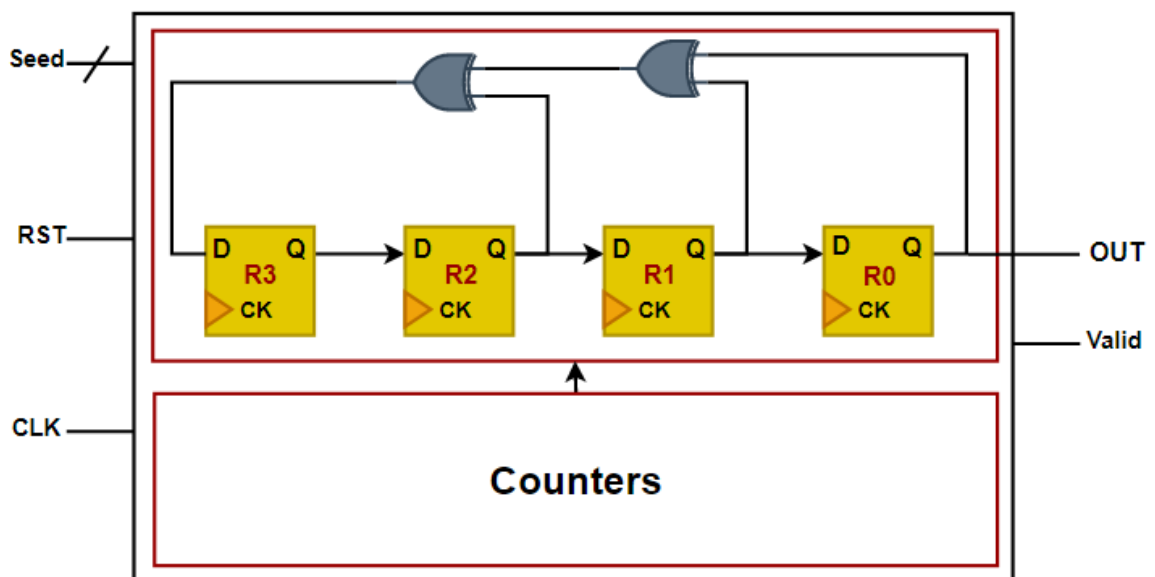
LFSR Applications

- 1) Pattern Generators
- 2) Encryption
- 3) Compression
- 4) CRC
- 5) Pseudo-Random Bit Sequences (PRBS)

LFSR Specification and Operation:

1. Initialize the shift registers using **Asynchronous Reset** with **seed**
2. Allow the LFSR to operate for 8 cycles (LFSR Mode) then stop and shift out the content of the 4 registers through OUT signal ($R3 > R2 > R1 > R0 > \text{OUT}$) (Shift Mode).
3. Counter is responsible for counting to 8 then flag a signal to stop the LFSR.
4. Valid signal is high when the output is valid, otherwise low.
5. All outputs are registered.

Block Diagram



Requirements: -

- 1- Design a **LFSR** with the above specifications using Verilog language.
- 2- Write a testbench to validate your design using
 - LFSR seed: 4'b1001
 - Clock frequency: 10 MHz